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Floral Resource Dynamics for Pollinators in a Central Iowa Tallgrass Prairie Restoration

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Background

Recently, native and managed colonies of pollinators, including bees, butterflies, and other insects, have experienced a large-scale declines. In an effort to restore habitat for pollinators, the United States Department of Agriculture's Farm Service Agency (FSA) created the CP-42 Pollinator Habitat conservation practice under the Conservation Reserve Program. This program pays private landowners to restore habitat for pollinator species with ecological and economic importance. To qualify for the program, CP-42 seed mixes must include:

- A minimum of 9 pollinator-friendly flowering plants,
- A minimum of three species in bloom during each of three seasonal periods (April-June 15, June 15-July, August-October), and
- no more than 25% native, non-sod forming grasses.

Since 2014, more than 200,000 acres have been enrolled in the CP-42 program in Iowa with virtually no post-seeding monitoring or evaluation. To determine whether CP-42 sites are likely to meet the program's floral resource targets, we analyzed a 5-year data set on flower phenology from an existing prairie restoration established with a similar seed mix.

Methods

- Data come from a long-term field experiment in prairie restoration at the Cedar River Ecological Research Site in Black Hawk County, Iowa. See Myers et al (2015) for details on site establishment and management.
- We analyzed 5 years of flower phenology data from a 32 species seed mix (P32) that included 20 forb and 12 graminoid species.
- The P32 forb seeding rate (26 pure live seeds/sq ft) was comparable to a typical CP-42 seed mix (~30 forb seeds/sq ft); however, the graminoid component greatly exceeded (55 pls/sq ft) CP-42 guidelines (~10 grass seeds/sq ft). However, other studies have illustrated that diverse mixes with higher grass to forb seeding ratios perform as well or better than forb-heavy pollinator mixes in producing nectar plants (Meissen et al., 2017)

Research Questions

- Are there three P32 species in bloom during each of the CP-42 periods? Which species are most abundant?
- Does P32 habitat quality remain suitably high over 5 years? Is there an increase or decrease in flower abundance over time?

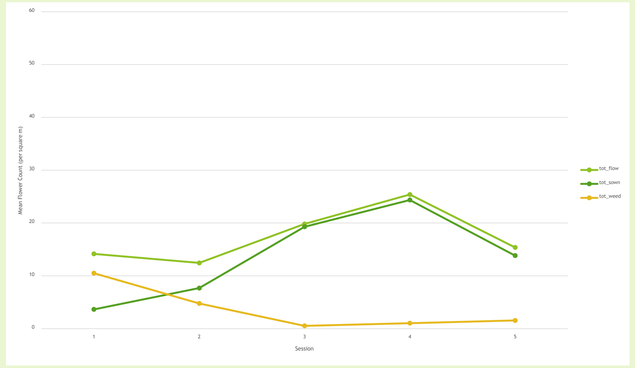
Table 1. P32 seed mix composition.

Scientific name*	Common name	Functional group
Panicum virgatum	switchgrass	C4 grass
Andropogon gerardii	big bluestem	C4 grass
Schizachyrium scoparium	little bluestem	C4 grass
Bouteloua curtipendula	side-oats grama	C4 grass
Sorghastrum nutans	indiangrass	C4 grass
Agropyron smithii	western wheatgrass	C3 grass
Elymus canadensis	Canada wildrye	C3 grass
Elymus virginicus	Virginia wildrye	C3 grass
Astragalus canadensis	milk vetch	Legume
Desmodium canadense	showy tick trefoil	Legume
Heliopsis helianthoides	ox-eye sunflower	Forb
Lespedeza capitata	round-headed bush clover	Legume
Oligoneuron rigidum	stiff goldenrod	Forb
Ratibida pinnata	yellow coneflower	Forb
Helianthus grosseserratus	saw-tooth sunflower	Forb
Silphium laciniatum	compass plant	Forb
Carex bicknellii	copper-shoulder oval sedge	Sedge
Carex brevior	plains oval sedge	Sedge
Carex gravida	long-awned bracted sedge	Sedge
Sporobolus compositus	composite dropseed	C4 grass
Amorpha canescens	leadplant	Legume
Artemisia ludoviciana	prairie sage	Forb
Dalea purpurea	purple prairie clover	Legume
Echinacea pallida	pale purple coneflower	Forb
Eryngium yuccifolium	rattlesnake master	Forb
Monarda fistulosa	wild bergamot	Forb
Symphyotrichum laeve	smooth blue aster	Forb
Symphyotrichum novae-angliae	New England aster	Forb
Tradescantia bracteata	longbract spiderwort	Forb
Zizia aurea	golden alexanders	Forb
Phlox pilosa	downy phlox	Forb
Baptisia leucantha	white wild indigo	Legume

Results

Figure 1. Total mean abundance of sown flowers, weeds, and all flowers in P32 plots during 5 seasonal periods (1 = June 1 to June 20; 2 = June 21 to July 10; 3 = July 11 to July 31; 4 = August 1 to 31; 5 = Sept 1 to Sept 31) in a) 2010, b) 2011, b) 2012, d) 2013, and e) 2014

a)



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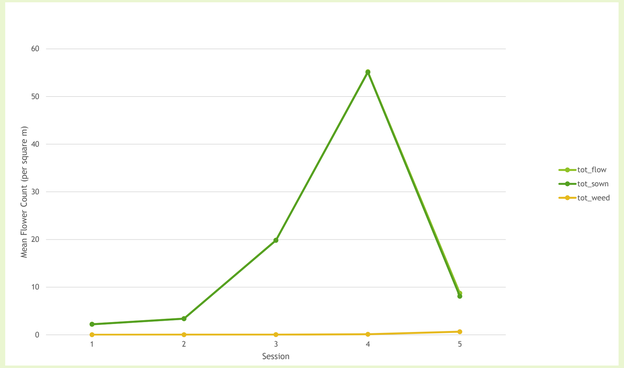

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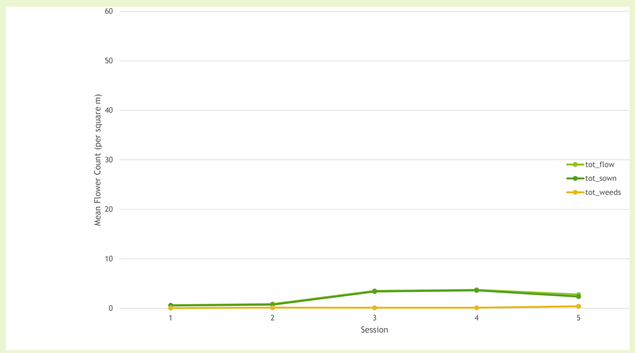

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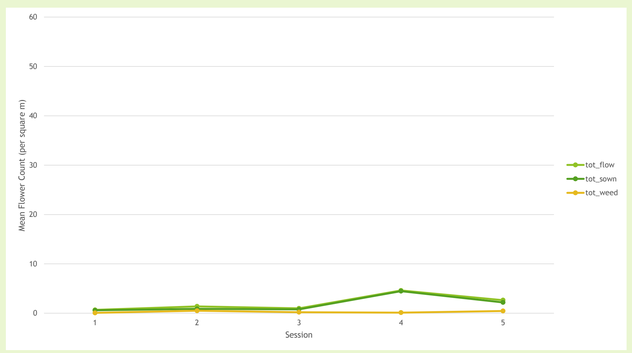

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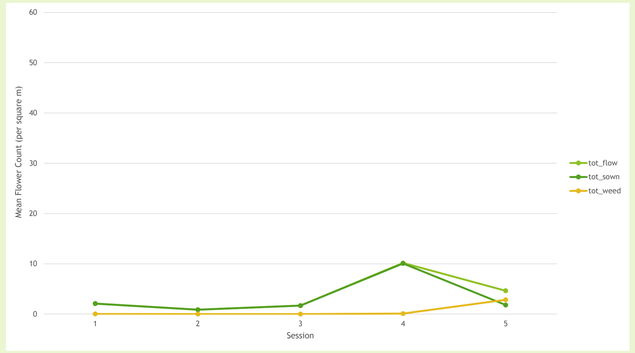


Potential Management & Environmental Effects:

- 2010: establishment year / no management
- 2011: spring prescribed burn
- 2012: spring biomass harvest (summer drought)
- 2013: no management (May/June floods)
- 2014: spring prescribed burn (June floods)

Photo of a P32 prairie planting

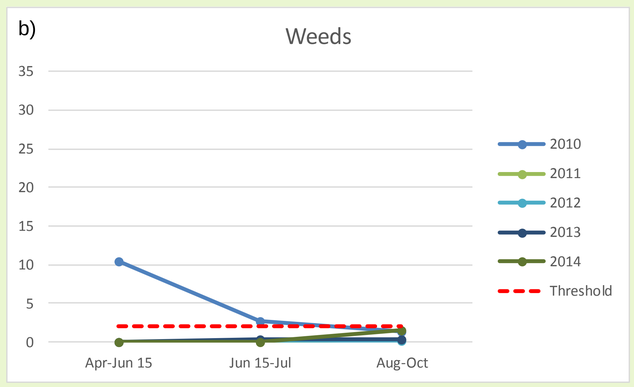
Table 1. Total # of species in bloom during CP-42 periods at various bloom abundance thresholds

	PERIOD 1 (April to June 15)			
Year	Total # sown species	Sown > 1 flower per 10 m^2	Sown >1 flower per m^2	Weeds (>1 flower per m^2)
2010	6	4	2 (hehe, phpi)	9 (1, meof)
2011	4	3	1 (ziau)	1 (0)
2012	5	2	0	3 (0)
2013	3	2	0	2 (0)
2014	4	2	1 (trbr)	1 (0)
	PERIOD 2 (June 15 to July)			
Year	Total # sown species	Sown > 1 flower per 10 m^2	Sown >1 flower per m^2	Weeds (>1 flower per m^2)
2010	9	6	1 (hehe)	11 (1, meof)
2011	11	8	1 (hehe)	3 (0)
2012	14	4	1 (hehe)	3 (0)
2013	9	3	0	3 (0)
2014	11	3	0	0
	PERIOD 3 (August to October)			
Year	Total # sown species	Sown > 1 flower per 10 m^2	Sown >1 flower per m^2	Weeds (>1 flower per m^2)
2010	11	7	2 (deca, hehe)	14 (0)
2011	12	9	2 (deca, hehe)	5 (0)
2012	10	4	1 (deca)	4 (0)
2013	12	5	1 (deca)	3 (0)
2014	14	7	1 (deca)	3 (1, sypi)

Figure 2. P32 survey sessions 1-5 re-formatted to fit CP-42 bloom periods for: a) sown species, b) weeds, and c) total flowers. Dashed red line indicates a bloom threshold of 2 flowers per m^2.

a)

b)



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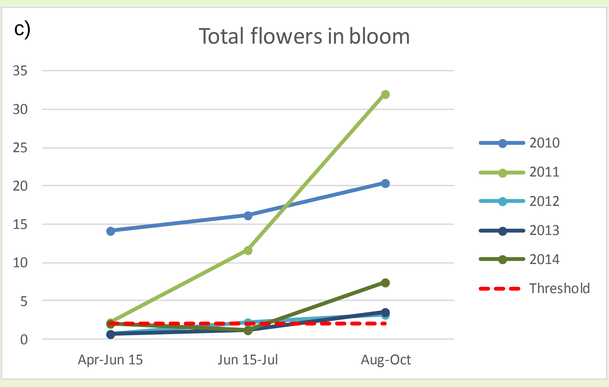

Conclusions

- Floral resources were dominated by sown species, and flower abundance declined greatly after Year 2.
- Total and sown flower abundance was < 2 flowers per m^2 during Period 1 in 2012 and 2013 and during Period 2 in 2013 and 2014.
- The most abundant sown species were *Phlox pilosa*, *Zizia aurea*, and *Tradescantia bracteata* in Period 1, *Heliopsis helianthoides* in Period 2, and *Heliopsis helianthoides* and *Desmodium canadense* in Period 3.
- After Year 1, weeds contributed only a minor portion of total flower abundance. Early season sweet clovers and late season frost aster and goldenrods were the most common weeds.
- With no density threshold, the P32 seed mix met the requirement of 3 species in bloom during each CP-42 seasonal period.
- With a bloom threshold of 1 flower per 10 m^2, the site did not meet the requirement of 3 species in bloom during Period 1 in 2012, 2013, or 2014.
- With a bloom threshold of 1 flower per 1 m^2, the site did not meet the requirement of 3 species in bloom during any seasonal period in any year.
- While the P32 seed mix met the general requirements of the CP-42 program, the abundance and diversity of floral resources declined over time, particularly in the first seasonal period (April-June 15).

Acknowledgements

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